| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ***BIOMARKER*** | ***MARKER FOR*** | ***SAMPLE MATERIAL*** | ***SAMPLE VOLUME*** | ***VALID. METHOD AVAIL*** | ***SENSITIVITY (LLD)*** | ***SMOKE PHASE*** | ***MS CONC. (ug/cig.)*** | ***CONC. IN BIOSAMPLE SM*** | ***NSM*** | ***SM/NSM*** |
| 2 | Acetonitrile | Uptake | exhalate | depends on sampling method--bag or adsorbent tube | proton transfer reaction MS | | GVP | 44-140 (4) | 69 ppb | <5.7 ppb 30ppb(95) | ~12 |
| 3 | | Uptake | blood | 2 ml (1) | head-space GC | | GVP | 44-140 (4) | 148 ug/l (7) | 0 | 1.8 |
| 4 | | Uptake | urine | 2 ml (1) | head-space GC | | GVP | 44-140 (4) | 118 ug/l (99) | 2.9 ug/l (99) | |
| 5 | Cadmium | Uptake | blood | 1 ml (3) | | 0.02 ug/l | PP | 100 - 200? | | | 4 to 8 |
| 6 | | Uptake | urine | 1 ml (3) | | 0.02 ug/l | PP | | | | |
| 7 | Carbon monoxide | Uptake | exhalate | depends on sampling method--bag or adsorbent tube | | | GVP | 1.8 - 13.7mg(A) | >8 ppm (C); 29.5 ppm (D) | <8 ppm (C); 6.5 ppm (D) | 6 |
| 8 | Carboxy-hemoglobin | Carbon monoxide uptake | blood | 5 ml (Tony email) | | | PP | NA | 69 ppth (D) | 22 ppth (D) | ~2 to 6.5 h (6) |
| 9 | Hb adducs of 3-aminobiphenyl | 3-AB uptake | blood | 5-10 ml (2) add toluidine | | | PP | NA | | | 11 to 12 |
| 10 | Hb adducs of 4-aminobiphenyl | 4-AB uptake | blood | 5-10 ml (2) add p- toluidine | HPLC (99) GCMS (97) | | PP | NA | 144-633pg/g Hb (E) 488 ± 174 (97) | 18.3 pg/g Hb (E) 29.6 ± 16.2 (97) | 3 to 5 |

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| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Nicotine | Nicotine uptake | urine | 1 ml (89) | Liquid chromato-graphy/atmo spheric pressuri-zation/ Tandem mass spec-trometry (LC/API/ MS | ~1 ng/ml (2) | PP | 0.15-2.04 mg (A) | | | |
| 12 | Cotinine | Nicotine uptake | urine | (included in 11) | | ~10 ng/ml (2) | PP | | | 1-30 ng/me (88) | |
| 13 | t-3-Hydroxy cotinine | Nicotine uptake | urine | (included in 11) | | | PP | NA | | | |
| 14 | nicotine glucoronide | Nicotine uptake | urine | (included in 11) | | | PP | NA | | | |
| 15 | cotinine glucuronide | Nicotine uptake | urine | (included in 11) | | | PP | NA | | | |
| 16 | t-3-Hydroxycotinine glucoronide | Nicotine uptake | urine | (included in 11) | | | PP | NA | | | |
| 17 | NNAL | NNK-uptake | urine | 100 mL(B) | | | PP | NA; NNK ~100ng/cigt | 3218 pmol/day (F) | 12.5 pmol/day (F) | ~120 |
| 18 | NNAL-glucoronide | NNK-uptake | urine | 100 mL(B) | | | PP | NA; NNK ~100ng/cigt | 1494 pmol/day (F) | 14.1 pmol/day (F) | ~120 |

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| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | B(a)P | B(a)P uptake | | | | | | | | | |
| 20 | DNA adducts | | | | | | | | | | |
| 21 | | | | | | | | | | | |
| 22 | Thromboxane B2 | Li;id peroxidation (oxidative stress) | urine | | | | NA | NA | 57 +- 8 pg/mg creatinine (8) | 22 +- 2 pg/mg creatinine | |
| 23 | HDL | Atherosclerosis | blood | | | | NA | NA | | | |
| 24 | LDL | Atherosclerosis | blood | | | | NA | NA | | | |
| 25 | Isoprostanes | Li;id peroxidation (oxidative stress) | urine | | | | NA | NA | | | |
| 26 | Malondialdehyde | Oxidative stress | blood | 1 ml plasma (Tony email) | | | NA | NA | | | |
| 27 | Fibrinogen | Cardiovascular disease | blood | | | | NA | NA | | | |
| 28 | Vitamin C | | blood | | | | | | | | |
| 29 | Vitamin E | | blood | | | | | | | | |

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| | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|
| 1 | ***ETS OCCURRENCE*** | ***HALF LIFE*** | ***METABOLISM KNOWN*** | ***NON-CIG. SOURCES*** | ***OTHER CONFOUNDERS*** | ***RECOMMENDATION*** | ***REFERENCE*** |
| 2 | 18 ug/m3 (restaurant)(5) 17 and 3 in residence (94) | 24 (+slow component) (98) | | Endogenonis (?) (95) | Some milk products (e.g. Kefir), combustion of wood, straw (HSDB, 2000) | One of the rare GVP markers | (4) Schmeltz and Hoffmann, 1977); Higgins et al., 1991 (7) Huerto et al., 1997 (95) email Sanders, July 21. (94) Ginerin book |
| 3 | | 32 h | | | | | (98) Jordan et al. 1995 |
| 4 | | | | | | | (1) see Oey (99) McKee et al. 1962 |
| 5 | | | | Diet, occupational | | | (3) see Elves |
| 6 | | | | | | | (3) see Elves |
| 7 | Yes | 3.5 to 7 h | yes | incomplete combusion of organic materials | Exposure to organic solvents of which CO is a metabolite | | (A)Adams, O"Mara-Adams, Hoffmann, Toxic and carcinogeic agents in undiluted mainstream smoke and sidestream smoke to different types of cigarettes, Carcinogenesis, 8(5), pp. 729 - 731, 1987; (C) Vogt, Selvin, SJWiddowson, Hulley, Expired Air Carbon Monoxide ans Serum Thiocyanate As Objective Measures of Cigarette Exposure, AJPH June, 1977, 67 (6), pp.545 - 548; (D) Heinemann, G., H. Schievelbein, and F. Richter, Analytical and Diagnostic Validity of the Determiation of carboxyhemoglobin in Blood and Carbon Monoxide in the Breath of Smokers and Non-Smokers. J. Clin. Chem., Clin. Biochem., 22, pp. 229 -235, |
| 8 | NA | 2 to 6.5 h (6) | yes | | | easy to do, but may not provide adequate discrimination between smokers and non-smokers | (6) Peterson and Steward, 1970 |
| 9 | 3- and 4-ABP probably below limit of detection | 7 to 9 weeks | yes | of the ABPs: azo-dyes, cutting fluids, possibly diet and pesticides | | | (2) see Stabbert |
| 10 | 104.3 ± 26.5 pg/mg HB (96) | | yes | of the ABPs: azo-dyes, cutting fluids, possibly diet, pesticides, and diesel exhaust | occupational | | (2) see Stabbert; (E) S. R. Myers, J. A. Spinnato, M. T. Pinorini-Godly, Characterization of r-amino-biphenyl-hemoglobin adductss in material and fetal blood samples; J. Toxicol. Environ. Health, 47, pp. 553-556, 1996. (97) Pinorini Godly, M.T. and Myers, S.R., 1996 (96) Ross, M.P. and Myers, S., 1999 |

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| | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|
| 11 | <0.01-131 ug/m3 (1) | 2 h | Yes (3) | | | essential to study of exposure to tobacco smoke | Leyden. Reference list can be provided. (2) Davis, R.A. and Curvall, M., Determination of nicotine and its metabolites in biological fluids: In vivo studies, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 583-643 (3)(1) Gorrod, J.W. and Schepers, G., Biotrans-formations of nicotine in mammalian systems, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 45-67 and references therein. |
| 12 | No | 10-17 h (87) | Yes (1) | | | | (1) Gorrod, J.W. and Schepers, G., Biotransformations of nicotine in mammalian systems, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 45-67 and references therein. (87) Jterematen, G.A. and Vesel, E.S., Metabolism of nicotine, Drug. Metab. Rev., (1991) |
| 13 | No | | Yes (1) | | | | (1) Gorrod, J.W. and Schepers, G., Biotransformations of nicotine in mammalian systems, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 45-67 and references therein. |
| 14 | No | | Yes (1) | | | | (1) Gorrod, J.W. and Schepers, G., Biotransformations of nicotine in mammalian systems, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 45-67 and references therein. |
| 15 | No | | Yes (1) | | | | (1) Gorrod, J.W. and Schepers, G., Biotransformations of nicotine in mammalian systems, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 45-67 and references therein. |
| 16 | No | | Yes (1) | none | none | | (1) Gorrod, J.W. and Schepers, G., Biotransformations of nicotine in mammalian systems, in Analytical Determination of Niotine and Related Compounds and their Metabolites, Gorrod, J.W. and Jacob, III, P., Eds., Elsevier, 1999, pp 45-67 and references therein.(B) 4. Carmella, S.G., S.A. Akerkar, J.P. Richie, Jr., and S.S. Hecht (1995). Intraindividual and interindividual differences in metabolites of the tobacco-specific lung carcinogen 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) in |
| 17 | NNK: 9-23 ng/m3 (F) | 45.2 ± 26.9 days (92) | yes | none | none | | (F) Meger, M., I. Meger-Kossien, K. Riedel, and G. Scherer (2000). Biomonitoring of environmental tobacco smoke (ETS)-related exposure to 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK). Biomarkers, 5, 33-45. (92) Hecht et al. 1999 |
| 18 | NNK: 9-23 ng/m3 (F) | 39.6 ± 26.0 days (92) | yes | | | | (92) Hecht et al. 1999 |

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| | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|
| 19 | | | yes | diet and water (-98%), indoor and outdoor air (91) | | analysis of B(a)P metabolites very difficult, smoking only minor contributor to daily intake | (91) Hattemer-Frey and Travis, 1991 PM submissioon to NTP 1998 |
| 20 | | | | | | | |
| 21 | | | | | | | |
| 22 | NA | 1 to 2 days | Yes | | Oral contraceptives containing ethinyl extrad:01 (94); pre- or postmenopause (93) | | (8) Uedelhoven et. al., 1991 (94) Stanczyle et al. 1999 (93) Fischer et al, 1986 |
| 23 | NA | | | | | | |
| 24 | NA | | | | | | |
| 25 | NA | 2 to 3 days | | | | | |
| 26 | NA | 6 days | | | | | |
| 27 | NA | | | | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |

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